

Claims

What is claimed is:

- 5 1. An integrated assembly adapted to mount in a vehicle between an engine, having a crankshaft assembly extending therefrom, and a transmission, having a transmission input shaft and stator shaft extending therefrom, the integrated assembly comprising:
- 10 a housing adapted to mount between the engine and the transmission;
- a torque converter assembly, located within the housing and adapted to mount adjacent to the engine, with the torque converter assembly including a cover adapted to rotatably couple to the crankshaft assembly, and an impeller rotationally coupled to the cover, and with the impeller including an impeller hub adapted to mount about the stator shaft; and
- 15 a motor-generator, located within the housing adjacent to the impeller and adapted to mount between the torque converter assembly and the transmission, with the motor-generator having an ISG stator supported by the housing, an ISG rotor support mounted and rotatable relative to the housing, and with an ISG rotor mounted on the ISG rotor support adjacent to the ISG stator, and at least one flexible member connected between the ISG rotor support and the impeller such that the ISG rotor is rotationally coupled to the impeller.
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2. The integrated assembly of claim 1 wherein the at least one flexible member is an ISG flex plate.
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3. The integrated assembly of claim 1 wherein the at least one flexible member is a set of compliant pin assemblies.
4. The integrated assembly of claim 3 wherein the set of compliant
- 30 assemblies includes a plurality of rigid pins connected to the impeller and a plurality of flexible cylinders, one each mounted between each of the pins and the ISG rotor support.

5. The integrated assembly of claim 1 further including at least one bearing mounted between the ISG rotor support and the housing.

5 6. The integrated assembly of claim 5 further including at least one bearing mounted between the housing and the impeller hub.

7. The integrated assembly of claim 1 wherein the impeller includes an outer radial surface, and the ISG rotor includes an outer radial surface that is radially
10 inward of the impeller outer radial surface.

8. The integrated assembly of claim 1 wherein the impeller has a generally semi-toroidal shape at a location adjacent to the motor-generator, and wherein the ISG rotor has a surface adjacent to the impeller that is shaped to match the shape of
15 the impeller at the location.

9. An integrated assembly adapted to mount in a vehicle between an engine, having a crankshaft assembly extending therefrom, and a transmission, having a transmission input shaft and stator shaft extending therefrom, the integrated assembly
20 comprising:

 a housing adapted to mount between the engine and the transmission;

 a torque converter assembly, located within the housing and adapted to mount adjacent to the engine, with the torque converter assembly including a cover adapted to rotatably couple to the crankshaft assembly, and an impeller rotationally coupled
25 to the cover, and with the impeller including an impeller hub adapted to mount about the stator shaft;

 a bearing mounted between the impeller hub and the housing; and

 a motor-generator, located within the housing adjacent to the impeller and adapted to mount between the torque converter assembly and the transmission, with
30 the motor-generator having an ISG stator supported by the housing, an ISG rotor support riding on a bearing mounted to the housing, and with an ISG rotor mounted on the ISG rotor support adjacent to the ISG stator, and a set of compliant pin

assemblies connected between the ISG rotor support and the impeller such that the ISG rotor is rotationally coupled to the impeller.

10. The integrated assembly of claim 9 wherein the set of compliant pin
5 assemblies includes a plurality of rigid pins connected to the impeller and a plurality of flexible cylinders, one each mounted between each of the pins and the ISG rotor support.

11. The integrated assembly of claim 9 wherein the impeller includes an
10 outer radial surface, and the ISG rotor includes an outer radial surface that is radially inward of the impeller outer radial surface.

12. The integrated assembly of claim 11 wherein the impeller has a generally
semi-toroidal shape at a location adjacent to the motor-generator, and wherein the
15 ISG rotor has a surface adjacent to the impeller that is shaped to match the shape of the impeller at the location.

13. The integrated assembly of claim 1 wherein the impeller has a generally
semi-toroidal shape at a location adjacent to the motor-generator, and wherein the
20 ISG rotor has a surface adjacent to the impeller that is shaped to match the shape of the impeller at the location.

14. An integrated assembly adapted to mount in a vehicle between an engine,
having a crankshaft assembly extending therefrom, and a transmission, having a
25 transmission input shaft and stator shaft extending therefrom, the integrated assembly comprising:

a housing adapted to mount between the engine and the transmission;

a torque converter assembly, located within the housing and adapted to mount
adjacent to the engine, with the torque converter assembly including a cover adapted
30 to rotatably couple to the crankshaft assembly, and an impeller rotationally coupled to the cover, and with the impeller including an impeller hub adapted to mount about the stator shaft;

a motor-generator, located within the housing adjacent to the impeller and adapted to mount between the torque converter assembly and the transmission, with the motor-generator having an ISG stator supported by the housing, an ISG rotor support riding on ISG bearings mounted to the housing, with the impeller hub supported by the ISG rotor support, an ISG rotor mounted on the ISG rotor support adjacent to the ISG stator, and a rotationally rigid, axially flexible member connected between the ISG rotor support and the impeller such that the ISG rotor is rotationally coupled to the impeller; and

a bearing mounted between the ISG rotor support and the housing.

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15. The integrated assembly of claim 14 wherein the rotationally rigid, axially flexible member is an ISG flex plate.

16. The integrated assembly of claim 14 further including a static seal contained between the impeller hub and the ISG rotor support.

17. The integrated assembly of claim 14 wherein the impeller includes an outer radial surface, and the ISG rotor includes an outer radial surface that is radially inward of the impeller outer radial surface.

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18. The integrated assembly of claim 17 wherein the impeller has a generally semi-toroidal shape at a location adjacent to the motor-generator, and wherein the ISG rotor has a surface adjacent to the impeller that is shaped to match the shape of the impeller at the location.

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19. The integrated assembly of claim 14 wherein the impeller has a generally semi-toroidal shape at a location adjacent to the motor-generator, and wherein the ISG rotor has a surface adjacent to the impeller that is shaped to match the shape of the impeller at the location.

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20. The integrated assembly of claim 14 wherein the ISG bearings comprises two spaced apart bearings.